



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/743,275	12/23/2003	Vaidyanathan Balasubramaniam	071469-0306881	4465

909 7590 11/16/2006

PILLSBURY WINTHROP SHAW PITTMAN, LLP
P.O. BOX 10500
MCLEAN, VA 22102

EXAMINER

NGUYEN, THANH T

ART UNIT PAPER NUMBER

2813

DATE MAILED: 11/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/743,275	BALASUBRAMANIAM ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 September 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-6, 12-14 and 16-33 is/are pending in the application.
- 4a) Of the above claim(s) 25-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-6, 12-14 and 16-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Request for Continued Examination

The request filed on 9/29/06 for a Request for Continued Examination (RCE) under 37 CFR 1.114 is acceptable and an RCE has been established. An action on the RCE follows.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 5-6, 12-14, 18, 23-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen (U.S. Patent No. 5,970,376).

Referring to figures 4, 7, Chen teaches a method for removing photoresist from substrate comprising:

Disposing the substrate (30) in a plasma processing system () the substrate having a dielectric layer (32) formed thereon with the photoresist (34a/34b) overlying the dielectric layer,

Art Unit: 2813

wherein the photoresist (34a/34b) provide a mask for etching a feature into the dielectric layer (see figures 4-5);

Introducing a process gas comprising N_xO_y , wherein x and y are integers greater than or equal to unity (see col. 11, lines 1-13);

Forming a plasma from the process gas in the plasma processing system (see col. 11, lines 1-13); and

Removing the photoresist from the substrate with the plasma (see col. 11, lines 1-13), wherein dielectric layer comprises at least one of hydrogen silsesquioxane and methyl silsesquioxane (see col. 8, lines 48-57).

Regarding to claim 5, the disposing of the substrate having the dielectric comprises disposing the substrate having a low dielectric constant dielectric layer (see col. 8, lines 12-15).

Regarding to claim 6, the disposing of the substrate having the dielectric layer comprises disposing the substrate having at least one of a porous dielectric layer, and a non-porous dielectric layer (see col. 8, lines 48-57, note that the dielectric layer either porous or non-porous).

Regarding to claim 12, the disposing of the substrate having the dielectric layer comprises disposing the substrate having the dielectric layer including a collective film including silicon, carbon, and oxygen (see col. 8, lines 48-57).

Regarding claim 13, the disposing of the substrate having the dielectric layer comprises disposing hydrogen in the collective film (see col. 8, lines 48-57).

Regarding to claim 18, the removing of the photoresist is performed for a first period of time (see col. 11, lines 1-13).

Regarding to claims 23, transferring of said photoresist pattern to said dielectric layer by etching is performed in a plasma processing system, and said removing of said photoresist from said dielectric Layer is performed in said plasma processing system (col. 9, lines 30-67, col. 10, lines 1-3, col. 17, lines 4-15)

Regarding to claims 24, Transferring of said photoresist pattern to said dielectric layer by etching is performed in a plasma processing system, and said removing of said photoresist from said dielectric Layer is performed in another plasma processing system (see col. 17, lines 4-15).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-4, 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (U.S. Patent No. 5,970,376) as applied to claims 1, 5-6, 12-14, 18, 23-24 in view of Zhu et al. (U.S. Patent Publication No. 20050079710).

Referring to figures 4, 7, Chen teaches a method for removing photoresist from substrate comprising:

Disposing the substrate (30) in a plasma processing system () the substrate having a dielectric layer (32) formed thereon with the photoresist (34a/34b) overlying the dielectric layer,

Art Unit: 2813

wherein the photoresist (34a/34b) provide a mask for etching a feature into the dielectric layer (see figures 4-5);

Introducing a process gas comprising N_xO_y , wherein x and y are integers greater than or equal to unity (see col. 11, lines 1-13);

Forming a plasma from the process gas in the plasma processing system (see col. 11, lines 1-13); and

Removing the photoresist from the substrate with the plasma (see col. 11, lines 1-13), wherein dielectric layer comprises at least one of hydrogen silsesquioxane and methyl silsesquioxane (see col. 8, lines 48-57).

However, the reference does not teach introducing of said process gas further comprises introducing an inert gas, introducing of said inert gas comprises introducing a Noble gas.

Zhu et al. teach claims 3, 16, introducing of said process gas further comprises introducing an inert gas (see paragraph# 25). Regarding to claims 4, 17, introducing of said inert gas comprises introducing a Noble gas (see paragraph# 25).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would use the process gas of inert gas and noble gas in process of Chen as taught by Zhu et al. because the process would control uniformity during the removal of the photoresist (see paragraph# 25).

Claims 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (U.S. Patent No. 5,970,376) as applied to claims 1, 5-6, 12-14, 18, 23-24 in view of Bao et al. (U.S. Patent Publication No. 2005/0130411).

Chen et al. teaches a method of stripping photoresist film on the organosilicate glass dielectric layer. However, the reference does not teach removing of photoresist determined by endpoint detection comprises utilizing optical emission spectroscopy.

Bao et al. teaches removing of photoresist determined by endpoint detection comprises utilizing optical emission spectroscopy (see paragraphs# 45, 54).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to removing the layer determined by endpoint detection comprises utilizing optical emission spectroscopy in process of Chen as taught by Bao et al. because the process would sense when the removing process complete to terminate the flow of the plasma gas.

With regarding to the limitation of removing the photoresist for the second time period. It would be obvious to one ordinary skill in the art to removing the photoresist layer for multiple time periods since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would remove the photoresist for the second time period in process of Chen et al. because the process would remove all of the photoresist residue from the underlying layer to provide a layer with free of contaminant.

Claims 1, 3-6, 12-14, 16-18, 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu et al. (U.S. Patent Publication No. 20050079710) in view of Gabriel et al. (U.S. Patent No. 6,599,839).

Referring to figures 2-5J, Zhu teaches a method for removing photoresist from a substrate comprising:

disposing said substrate in a plasma processing system (100), said substrate having a dielectric layer (OSG/cap) formed thereon with said photoresist (PR) overlying said dielectric Layer (OSG/cap), wherein said photoresist provides a mask for etching a feature into said dielectric Layer (see figures 2-5j),

introducing a process gas comprising N_xO_y , wherein x and y are integers greater than or equal to unity (see figures 2, paragraph# 25+);

forming a plasma from said process gas in said plasma processing system (206, see figures 2, paragraph# 25+); and

removing said photoresist from said substrate with said plasma (208, see figures 2, paragraph# 29+);.

Regarding to claims 3, 16. introducing of said process gas further comprises introducing an inert gas (see paragraph# 25).

Regarding to claims 4, 17, introducing of said inert gas comprises introducing a Noble gas (see paragraph# 25).

Regarding to claims 5. disposing of said substrate having said dielectric Layer comprises disposing said substrate having a low dielectric constant dielectric Layer (see paragraph# 23).

Regarding to claims 6. disposing of said substrate having said dielectric Layer comprises disposing said substrate having at Least one of a porous dielectric Layer, and a non-porous dielectric Layer (see paragraph# 23).

Regarding to claims 12, disposing of said substrate having said dielectric Layer comprises disposing said substrate having said dielectric Layer including a collective film including silicon, carbon, and oxygen (see paragraph# 23).

Regarding to claims 14. A method of forming a feature in a dielectric layer on a substrate comprising:

forming said dielectric Layer (OSG) on said substrate,
forming a photoresist pattern (PR) on said dielectric Layer;
transferring said photoresist pattern to said dielectric Layer by etching (see fig. 3a+), and
removing said photoresist from said dielectric Layer using a plasma formed with a process gas comprising N_xO_y , wherein x and y are integers greater than or equal to unity (see fig. 2+, paragraph# 25).

Regarding to claims 18. removing of said photoresist is performed for a first period of time (see paragraph# 2+).

Regarding to claims 23. transferring of said photoresist pattern to said dielectric layer by etching is performed in a plasma processing system, and said removing of said photoresist from said dielectric Layer is performed in said plasma processing system(100, see paragraph# 25+, figures 2+).

Regarding to claims 24, transferring of said photoresist pattern to said dielectric layer by etching is performed in a plasma processing system, and said removing of said photoresist from said dielectric layer is performed in another plasma processing system (see figures 2+, paragraph# 25+).

The reference forming a dielectric layer comprises an organosilicate glass (OSG). However the reference does not specifically explain that OSG layer comprises at least one of hydrogen silsesquioxane and methyl silsesquioxane, the disposing of the substrate having the dielectric layer comprises disposing hydrogen in the collective film.

Gabriel et al. teaches OSG layer comprises at least one of hydrogen silsesquioxane and methyl silsesquioxane (see col. 4, lines 23-33). It is noted that hydrogen silsesquioxane and methyl silsesquioxane has hydrogen.

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form OSG layer comprises at least one of hydrogen silsesquioxane and methyl silsesquioxane in process of Zhu et al. as taught by Gabriel et al. because OSG layer such as hydrogen silsesquioxane and methyl silsesquioxane has the low dielectric constants to prevent problems with capacitance, cross talk, between adjacent conducting layers and elements.

Claims 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhu et al. (U.S. Patent Publication No. 20050079710) in view of Gabriel et al. (U.S. Patent No. 6,599,839) as applied to claims 1, 3-6, 12-14, 16-18, 23-24, further in view of Bao et al. (U.S. Patent Publication No. 2005/0130411).

Zhu et al. in view of Suzuki teaches a method of stripping photoresist film on the organosilicate glass dielectric layer. However, the reference does not teach removing of photoresist determined by endpoint detection comprises utilizing optical emission spectroscopy.

Art Unit: 2813

Bao et al. teaches removing of photoresist determined by endpoint detection comprises utilizing optical emission spectroscopy (see paragraphs# 45, 54).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to removing the layer determined by endpoint detection comprises utilizing optical emission spectroscopy in process of Zhu et al. as taught by Bao et al. because the process would sense when the removing process complete to terminate the flow of the plasma gas.

With regarding to the limitation of removing the photoresist for the second time period. It would be obvious to one ordinary skill in the art to removing the photoresist layer for multiple time periods since it is well-known in the art to repeat the same process for multiple effect. See St. Regis paper, Co. V. Bemis Co. Inc. 193 USPQ 8, 11 (7th circuit 1977).

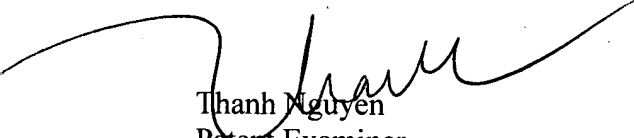
Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would remove the photoresist for the second time period in process of Zhu et al. because the process would remove all of the photoresist residue from the underlying layer to provide a layer with free of contaminant.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pairdirect.uspto.gov>. Should you have questions on access to thy Private PAIR system, contact the Electronic Business center (EBC) at 866-217-9197 (toll-free).



Thanh Nguyen
Patent Examiner
Patent Examining Group 2800